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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/571,083

03/06/2006

Alexandr V. KOZLOV

1000-0085

2409

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7590

04/13/2009

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EXAMINER

KASSA, ZEWDU A

ART UNIT

PAPER NUMBER

2611

MAIL DATE

DELIVERY MODE

04/13/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/571,083	<b>Applicant(s)</b> KOZLOV, ALEXANDR V.	
	<b>Examiner</b> ZEWDU KASSA	<b>Art Unit</b> 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 06 March 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/10/2006, 3/06/2006</u> .                                    | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hyll (US 6005893) in view of Tsuzuki (US 2001/0053973 A1).**

3. As per claim 1, a method for performing bit loading in a multicarrier communication system, comprising: obtaining transmission coefficients  $\alpha_n$ , for subchannels of a multicarrier channel, where  $n$  is a subchannel index (Hyll, claim 1, "estimate an error estimate on each channel"); calculating initial cost values for said subchannels using said transmission coefficients (Hyll, Claim 1 "allocating a number of bits to each subchannel ... error estimates").

4. Hyll does not explicitly teach identifying a subchannel  $n$  having a lowest cost value; allocating a new bit to said identified subchannel  $n$ ; and updating said cost value of said identified subchannel  $n$ , after allocating a

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new bit, using a cost function:  $\Delta P = f(C_n) - g(\alpha_n)$  where  $C_n$ , is a number of bits allocated to a subchannel  $n$ ,  $f(C_n)$  is a function of  $C_n$ , that returns a baseline cost value for allocating an additional bit to subchannel  $n$ , and  $g(\alpha_n)$  is a function of transmission coefficient  $\alpha_n$ . **Tsuzuki** teaches identifying a subchannel  $n$  having a lowest cost value (Tsuzuki, Fig. 13 item S12 – S15); allocating a new bit to said identified subchannel  $n$  (Tsuzuki, Fig. 13 item S12 – S15); and updating said cost value of said identified subchannel  $n$ , after allocating a new bit (Tsuzuki, Fig. 13 item S12 – S15), using a cost function:  $\Delta P = f(C_n) - g(\alpha_n)$  where  $C_n$ , is a number of bits allocated to a subchannel  $n$ ,  $f(C_n)$  is a function of  $C_n$ , that returns a baseline cost value for allocating an additional bit to subchannel  $n$ , and  $g(\alpha_n)$  is a function of transmission coefficient  $\alpha_n$  (Tsuzuki, Para [0031] “db” , Fig. 6 first col. as a function of bit, second col. as a function of db, a logarithmic unit, expressed as log of a square of a coefficient – it is obvious to one ordinary skill in the art to write cost function as shown -see Section III and IV of CHEUNG, YUI W., et al., "Multiuser OFDM with Adaptive Subcarrier, Bit, and Power Allocation", IEEE Journal on Selected Areas in Communication, Vol. 17, (October 1999)). Thus, it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to implement the instant limitation, as taught by Tsuzuki, in the apparatus of Hyll because Tsuzuki teaches the benefit of storing the values of the two functions in the lookup

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table so that to improve the performance, reduce cost and complexity in a bit allocation method (Tsuzuki, Para [0015], [0012]).

5. As per claim 2, Hyll in view of Tsuzuki teaches the method of claim 1, further comprising: repeating identifying, allocating, and updating for a total of K iterations, where R is a number of bits to be allocated (Tsuzuki, Fig. 13 item S12 – S15).

6. As per claim 3, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: said function  $g(\alpha_n)$  is equal to  $\log((\alpha_n)^2)$ , which is the logarithm of the square of the channel coefficient of subchannel n (Tsuzuki, Para [0031] “db” , Fig. 6 first col. as a function of bit, second col. as a function of db, a logarithmic unit, expressed as log of a square of a coefficient).

7. As per claim 4, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: updating said cost value includes retrieving a value for  $f(C_n)$  from a first lookup table (Tsuzuki, Fig. 6 first col. as a function of bit, Para [0031] “lookup table”).

8. As per claim 5, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: updating said cost value includes retrieving a value for  $g(\alpha_n)$  from a

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second lookup table (Tsuzuki, Para [0031] "db" "lookup table", Fig. 6 second col. as a function of db, a logarithmic unit, expressed as log of a square of a coefficient).

9. As per claim 6, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: calculating initial cost values includes evaluating the cost function:  $\Delta P = f(0) - \log((\alpha_n)^2)$  for each subchannel, where  $f(0)$  is a baseline cost value assuming no allocated bits for a subchannel  $n$  and  $\log((\alpha_n)^2)$  is the logarithm of the square of the channel coefficient of subchannel  $n$  (Tsuzuki, Para [0031] "db" , Fig. 6 first col. as a function of bit, initialize with "0", second col. as a function of db, a logarithmic unit, expressed as log of a square of a coefficient).

10. As per claim 7, Hyll in view of Tsuzuki teaches the method of claim 6, wherein: calculating initial cost values includes retrieving a value for  $f(0)$  from a first lookup table (Tsuzuki, Para [0031] "db" "lookup table", Fig. 6 first col. as a function of bit, initialize with "0").

11. As per claim 8, Hyll in view of Tsuzuki teaches the method of claim 6, wherein: calculating initial cost values includes retrieving values for  $\log((\alpha_n)^2)$  from a second lookup table for subchannels of said multicarrier channel

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(Tsuzuki, Para [0031] "db" "lookup table", Fig. 6 second col. as a function of db, a logarithmic unit, expressed as log of a square of a coefficient).

12. As per claim 9, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: obtaining transmission coefficients includes acquiring said transmission coefficients from a local channel estimator (Hyll, claim 1, "estimate an error estimate on each channel").

13. As per claim 10, Hyll in view of Tsuzuki teaches the method of claim 1, wherein: obtaining transmission coefficients includes receiving said transmission coefficients from a remote communication entity (Hyll, claim 1).

14. As per claim 11, Hyll teaches an apparatus comprising: a channel determination unit to obtain transmission coefficients  $\alpha_n$  for subchannels of a multicarrier channel (Hyll, claim 1, "estimate an error estimate on each channel"); a bit allocation calculator to determine bit allocations for said subchannels of said multicarrier channel using said transmission coefficients (Hyll, Claim 1 "allocating a number of bits to each subchannel ... error estimates").

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15. Hyll does not explicitly teach said bit allocation calculator to calculate cost values for said subchannels as a difference between a first function and a second function; a first lookup table to store and retrieve values of said first function for use by said bit allocation calculator; and a second lookup table to store and retrieve values of said second function for use by said bit allocation calculator. **Tsuzuki** teaches said bit allocation calculator to calculate cost values for said subchannels as a difference between a first function and a second function (Tsuzuki, Fig. 13 item S11); a first lookup table to store and retrieve values of said first function for use by said bit allocation calculator (Tsuzuki, Para [0031], [0015]); and a second lookup table to store and retrieve values of said second function for use by said bit allocation calculator (Tsuzuki, Para [0031], [0015]). Thus, it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to implement the instant limitation, as taught by Tsuzuki, in the apparatus of Hyll because Tsuzuki teaches the benefit of storing the values of the two functions in the lookup table so that to improve the performance, reduce cost and complexity in a bit allocation method (Tsuzuki, Para [0015], [0012]).

16. As per claim 12, Hyll in view of Tsuzuki teaches the apparatus of claim 11, wherein: said first function is a function that returns a threshold cost of



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allocating an additional bit to a subchannel based on a presently allocated number of bits (Tsuzuki, Fig. 6 – wherein first col. as a function of bits).

17. As per claim 13, Hyll in view of Tsuzuki teaches the apparatus of claim 11, wherein: said second function is a function that returns a logarithm of a square of a transmission coefficient for a corresponding subchannel (Tsuzuki, Fig. 6 second col., Para [0031] “db” is a logarithmic unit).

18. As per claim 14, Hyll in view of Tsuzuki teaches the apparatus of claim 11, wherein: said channel determination unit is a channel estimator to estimate said transmission coefficients using training signals received via said multicarrier channel (It is well known in the art to use a training sequence to estimate a channel condition or a subchannel condition).

19. As per claim 15, Hyll in view of Tsuzuki teaches the apparatus of claim 11, wherein: said bit allocation calculator is operative to: calculate initial cost values for said subchannels of said multicarrier channel assuming zero bits allocated to each subchannel (Tsuzuki, Fig. 13 item "start of bit allocation"), identify a subchannel with a lowest cost value, allocate an additional bit to said identified subchannel (Tsuzuki, Fig. 13 item S12 – S15), and update a cost value of said identified subchannel using

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information from said first and second lookup tables (Tsuzuki, Para [0031], [0015]).

20. As per claim 16, Hyll in view of Tsuzuki teaches the apparatus of claim 15, wherein: said bit allocation calculator is operative to: identify a subchannel with a lowest cost value, allocate an additional bit to said identified subchannel, and update a cost value (Tsuzuki, Fig. 13 item S12 – S15) of said identified subchannel using information from said first and second lookup tables for each bit to be included within a multicarrier symbol (Tsuzuki, Para [0031], [0015]).

21. As per claim 17, Hyll in view of Tsuzuki teaches the apparatus of claim 11, wherein: said multicarrier channel is an orthogonal frequency division multiplexing (OFDM) channel (Hyll, Col 1 L17-18 "DMT").

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ZEWDU KASSA whose telephone number is (571)270-5253. The examiner can normally be reached on Monday - Friday (7:30 - 5:00).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571 272 3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

zk

**/David C. Payne/  
Supervisory Patent Examiner, Art Unit 2611**